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Interactions of Distributed Resources with the Smart Grid

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**CPUC Smart Grid Rulemaking –
Consumer Issues Workshop**
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NIST Smart Grid Interoperability Standards Interim Roadmap Project

Goals

- Develop consensus-driven Interim Roadmap
- Identify process to develop and harmonize interoperability standards

April 28-29 Workshop

- Over 400 stakeholders worked in 7 tracks to begin consensus building and identify existing standards
- Drafted Release 1 Standards list

May 18: DOE/Commerce Press Release

- Announced list of 16 Release 1 Standards

May 19-20 Workshop

- Over 600 stakeholders worked to select interoperable standards for key interfaces between domains

May 31 Deliver Interim Roadmap to NIST

Applying a requirements-driven process to analyze standards against how well they meet the requirements

Initial Release 1 Standards List:

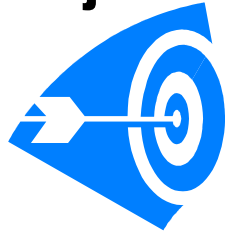
“Low-Hanging Fruit” in Customer Domain

- AMI-SEC System Security Requirements
 - Advanced metering infrastructure and Smart Grid end-to-end security
- ANSI C12.19 / MC1219
 - Revenue metering information model
- BACnet ANSI ASHRAE 135-2008 / ISO 16484-5
 - Building automation
- IEEE 1547
 - Physical and electrical interconnections between utility and DG
- Open Automated Demand Response
 - Price responsive and direct load control
- OpenHAN
 - System requirements for Home Area Network device communication, measurement, and control
- ZigBee/HomePlug Smart Energy Profile
 - Home Area Network (HAN) Device Communications and Information Model

Initial list announced to recognize existing “standards” identified as important for customer applications

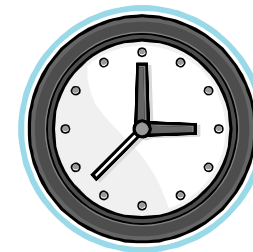
Importance of clear integration objectives: What using distributed resources for?

Integration Objectives



- Defer capital expansion
- Serve isolated remote load
- Power quality
- Low carbon future
- Market economics
- Reliability
- System protection

Time Horizon



Resource Planning (year)

Operational Planning (months)

Day-ahead Operations (day)

Day-of Operations (<day)

**Objective for using distributed resources implies
a time horizon for addressing system imbalance risk**

Importance of Risk Mitigation Objective: Which operational risk trying to avoid?

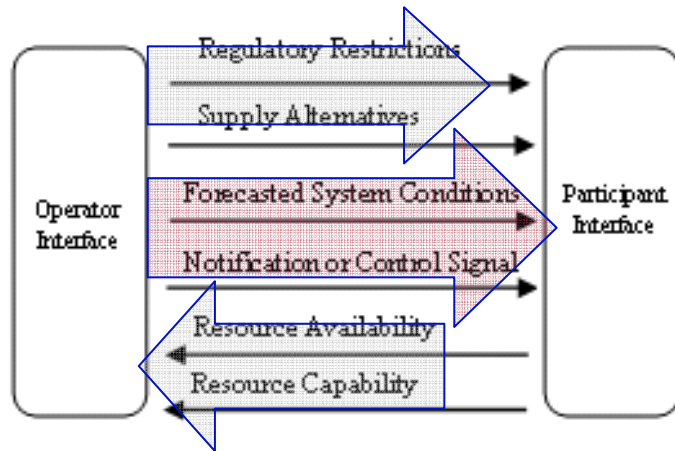
Characterizing Demand Response Programs:

- Operator risk mitigation objective
 - Price risk
 - Quantity risk
- Customer Incentive Structure
 - Participation rationale
- Actuation method
 - Agreed upon method of actuating a demand-side response

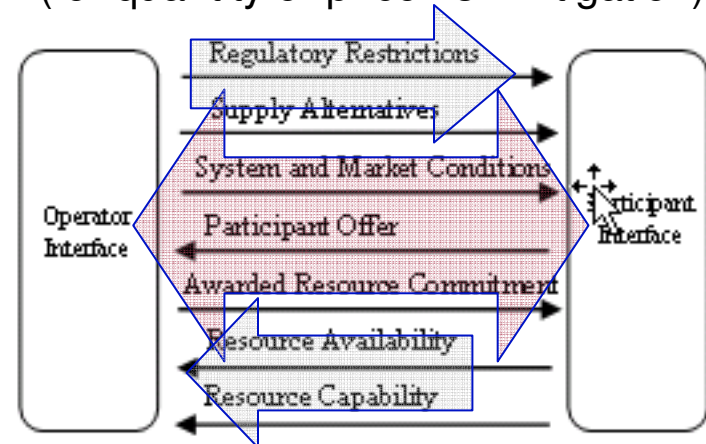
Risk Mitigation Objective influences information exchange requirements (e.g., type of information exchanged, direction, etc.)

Information Exchange Examples: Quantity Risk vs. Price Risk Mitigation

Quantity Risk Mitigation



Demand-Bidding (for quantity or price risk mitigation)



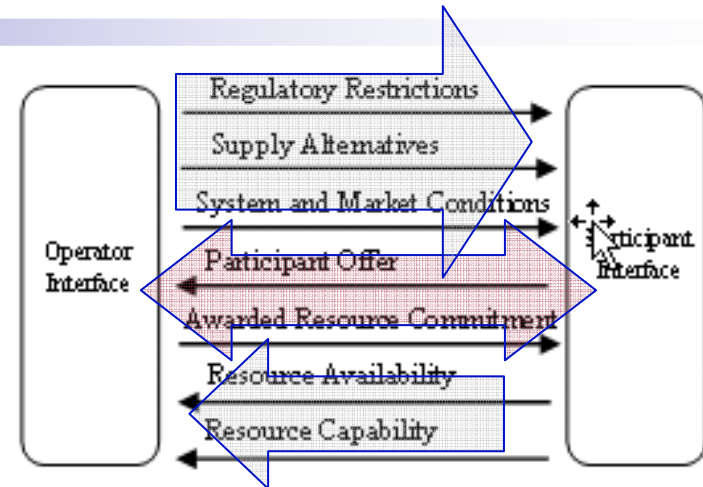
Dynamic Pricing (for price risk mitigation)



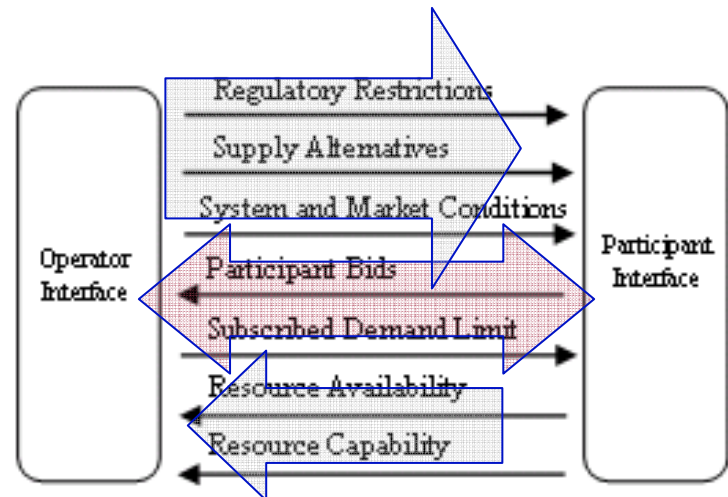
Determine/prioritize objectives and identify requirements before analyzing/picking technologies and “standards” to meet the requirements

Information Exchange Comparison: Demand Bidding vs. Demand Limiting

- Demand Bidding
 - Participant offer to sell vs. bid to buy



- Demand Limiting*
 - Configurable limit by customer subscription
 - Automation of response
 - enabled by smart grid infrastructure



Smart grids can enhance configurability and automation to support new uses and emerging applications for distributed resources

Recommendations

- Identify and prioritize objectives for use of distributed resources
 - Time horizon for addressing system imbalance risk
 - Actuation requirements
 - response time, communications and coordination requirements
- Apply requirements-driven process towards interoperability
 - Identify the uses and requirements to support objectives
 - Analyze standards against how they meet the requirements
- Structure incentives to support objectives
 - Customer adoption of enabling technologies
 - Coordination of customer resources to mitigate operational risk
- Support standards development at national level
 - e.g., participate in Demand Response Ready collaborative to establish requirements for which products can merit mark of distinction



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